First Guiding Model (Chemistry 2026)

1- An element from the first transition series, one of its compounds is used in dyes.
- Which of the following choices represents the electronic structure of this element's ion in this compound?

(a) $[_{18}Ar]\ 4s^1\ 3d^5$
(b) $[_{18}Ar]\ 3d^3$
(c) $[_{18}Ar]\ 4s^2\ 3d^3$
(d) $[_{18}Ar]\ 3d^2$

2- Which of the following expresses the electronic distribution of a non-transition element ion?

(a) X^{3+}: $[Ne]3s^2,3p^6$
(b) Y^{2+}: $[Ar]\ 3d^6$
(c) Z^{2+}: $[Ne]\ 3s^2,\ 3p^6$
(d) W^{3+}: $[Kr]\ 4d^7$

3- Four test tubes X, Y, Z, and W, each contain a salt solution as shown in the following table:

W	Z	Y	X
$V(NO_3)_5$	$Ti(NO_3)_3$	$Fe(NO_3)_3$	$Mn(NO_3)_2$

- Which of these tubes should be covered in order to not be change the composition of the solution inside it?

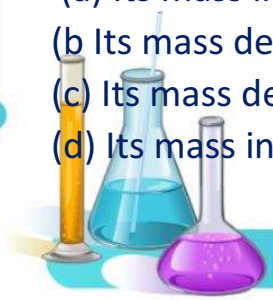
(a) X (b) Y (C) Z (d) W

4- Two consecutive transition elements (X) and (Y), from the first transition series contain the same number of electrons in the (3d) subshell.
-Which of the following is true?

(a) The effective nuclear charge of element (X) is greater than the effective nuclear Charge of element (Y)
(b) The radius of element (X) is smaller than the radius of element (Y)
(c) The radius of element (X) is equal to the radius of element (Y)
(d) The repulsion between the (3d) electrons of element (X) is less than the repulsion Between the (3d) electrons of element (Y)

5- Which of the following describes the change that occurs to siderite ore when Heated in air?

(a) Its mass increases and percentage of iron increases in it.
(b Its mass decreases and percentage of iron increases in it.
(c) Its mass decreases and percentage of iron decreases in it.
(d) Its mass increases and percentage of iron decreases in it.



6- Which of the following expresses the effect of the gas produced by (the reaction of dilute hydrochloric acid with sodium sulphite)?

(a) It turns a paper wet with potassium dichromate solution to green.

(b) It does not remove the color of acidified potassium permanganate solution.

(c) It turns a paper wet with lead acetate solution to black.

(d) It turns a paper wet with starch to yellow.

7-Which of the following reactions produces a precipitate?

(a) Hydrogen sulphide gas with lead (II) acetate solution

(b) Sodium thiosulphate solution with brown iodine solution

(c) Sulphur dioxide gas with acidified potassium dichromate solution

(d) Sodium nitrite solution with acidified potassium permanganate solution

8- When hot concentrated sulphuric acid reacts with salt (X), a gas that difficult to be oxidized by acid is released, and when the same acid reacts with salt (Y), a gas that is partially oxidized is released. Salts (X) and (Y) are:

	X	Y
A	Sodium chloride	Sodium iodide
B	Sodium bromide	Sodium iodide
C	Sodium nitrate	Sodium carbonate
d	Sodium chloride	Sodium sulphate

9- When barium chloride solution is added to salt solution (X), a white precipitate forms that dissolves in dilute acids, and when lead II acetate solution is added to salt solution (Y), a white precipitate forms.

- Which of the following expresses the anions of salts (X) and (Y)?

	Anion of salt (X)	Anion of salt (Y)
A	Phosphate	Sulphate
B	Phosphate	Sulphide
C	Sulphate	Phosphate
d	Chloride	Sulphate

10-From the following diagram:

White ppt. ← Diluted sulphuric acid | X^{2+} | → Sodium carbonate solution → White ppt.

-Which of the following represents cation (X^{2+}):-

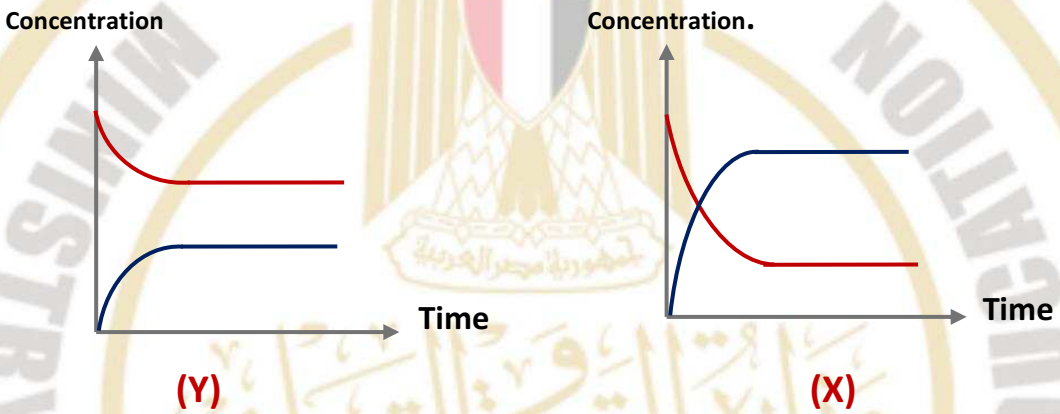
(a) Ca^{2+}

(b) Cu^{2+}

(C) Mg^{2+}

(d) Fe^{2+}

11-From the following graphs:



(Y) **(X)**

Which of the following statements is correct?

(a) Graph(X): Kc=1 , the backward reaction is the predominant

(b) Graph(Y): Kc=1 , the forward reaction is the predominant

(C) Graph(X): Kc>1 , the forward reaction is the predominant

(d) Graph(Y): Kc>1 , the backward reaction is the predominant

12- In the following equilibrium reaction:

$$Ca(OH)_{2(s)} \rightleftharpoons CaO_{(s)} + H_2O_{(v)}$$

Which of the following changes leads to an increase in the mass of calcium oxide?

(a) Reducing the mass of calcium oxide by half

(b) Withdrawal 10 mL of water vapor

(c) Doubling the mass of calcium hydroxide

(d) Adding 10 mL of water vapor

13- 50 mL of a 0.2 M ammonium hydroxide (NH_4OH) solution was diluted by adding 450 mL of distilled water. What is the dissociation degree (α) of the solution after dilution?

(Ammonia ionization constant $K_b = 1.8 \times 10^{-5}$)

(a) 0.03 (b) 0.0095

(c) 0.2 (d) 0.0009

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14- Test tubes (A) and (B) each contain a saturated calcium carbonate solution.

$$CaCO_{3(s)} \rightleftharpoons Ca^{2+}{}_{(aq)} + CO_3^{2-}{}_{(aq)}$$

- In tube (A), a few drops of hydrochloric acid were added.

- In tube (B), a few drops of calcium chloride solution were added.

- Which of the following is true?

(a) The amount of precipitate gradually increases in (A) and gradually decreases in (B)

(b) The amount of precipitate gradually decreases in (A) and gradually increases in (B)

(c) The amount of precipitate gradually increases in both tubes.

(d) The amount of precipitate gradually decreases in both tubes.

15- Drops of solution (X) were added to a quantity of distilled water, and a Decrease in the POH value of the water was observed.

- Which of the following describes solution (X)?

(a) Base pOH has a value of 8

(b) Acid pOH has a value of 5

(c) Base pH has a value of 8

(d) Acid pH has a value of 5

16-In the following balanced reaction:

$$C_{(S)} + CO_{2\,(g)} \rightarrow 2CO_{(g)}$$

-If the total pressure of this system at equilibrium is 40 atm and the partial pressure of carbon monoxide is 31.6 atm, then the value of Kp for this system is equal to:

(a) 8.487 (b) 3.760

(c) 118.87 (d) 131.98

17- A few drops of Na_2S solution were added to the cathode half-cell in a Daniel cell.

- Which of the following is correct?

(a) The (emf) of the cell increases.

(b) The cell consumption time decreases.

(c) The concentration of Cu^{2+} cations increases.

(d) The current reverses and the (emf) value decreases.

18- In the following reaction: $5Cl^- + 8H^+ + MnO_4^- \rightarrow \frac{5}{2} Cl_2 + 4\,H_2O + Mn^{2+}$

$$(Cl_2 / 2Cl^- = +1.36\ V,\ Mn^{2+} / Mn^{7+} = -1.52\ V)$$

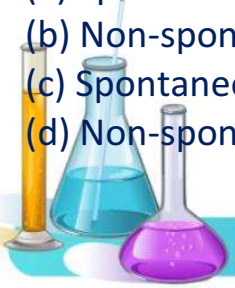
-Which of the following represents the type and value of (emf) of the reaction?

(a) Spontaneous, emf = + 0.16

(b) Non-spontaneous, emf = - 2.88 V

(c) Spontaneous and, emf = - 0.16 V

(d) Non-spontaneous, emf = + 2.88 V



19-The following table shows the components of two galvanic cells and the standard potential value for each:

Cell number	Anode	Cathode	emf
1	X	Ag	0.80 V
2	Y	Ag	1.56V

- If a galvanic cell with electrodes (X, Y) is formed, the (emf) of the cell is equal to:

(a) +2.36 V (b) - 2.36 V

(C) +0.76 V (d) - 0.76 V

20- The following table shows standard reduction potential of three metals (A, B, C)

A	B	C
-0.44	+0.34 V	+0.8

-When metals (A) and (B) are each covered with a layer of metal (C), which of the following best describes the type of protection?

(a) Anodic protection for (A), and cathodic protection for (B)

(b) Cathodic protection for (A), and cathodic protection for (B)

(c) Anodic protection for (A), and anodic protection for (B)

(d) Cathodic protection for (A), and anodic protection for (B)

21- When bauxite ore is analyzed electrically, which of the following statements describe the result of the reaction?

(a) Hydrogen gas evolves at cathode and oxygen gas evolves at anode.

(b) Aluminum metal is deposited at cathode and oxygen gas is formed at the anode.

(c) Aluminum metal is deposited at cathode and hydrogen gas is formed at anode.

(d) Oxygen gas evolves at cathode and hydrogen gas rises at anode.

22- Three metals (A, B, and C), are ordered according to their reducing agent Strength as follows: [A > B > C]

-When purifying metal (B), which contains impurities of (A) and (C), using an electrolytic cell containing an electrolyte solution of (B^{2+}) ions (under suitable conditions)

(a) Metal (C) is oxidized during the purification process.

(b) Metal (C) is reduced during the purification process.

(c) Metal (A) is oxidized at the anode and (C) is deposited at the anode.

(d) Metal (A) is reduced at the anode and (C) is deposited at the cathode.

23- (A, B, C) Three hydrocarbons:

(A): gas and one of the components of oven gas by smaller ratio in hot countries.

(B): Contains the same number of carbon atoms as compound (A), but its Molecular formula is two atoms less than that of compound (A).

(C): Unsaturated, its molecular formula two less hydrogen atoms than Compound (B).

-Which of the following represents the products of complete hydrogenation in the presence of a catalyst for each of the above compounds?

	Product of hydrogenation (A)	Product of hydrogenation (B)	Product of hydrogenation (C)
A	Propane	Propane	Propane
B	Butane	Propane	Propene
C	Butane	Cyclopropane	Propyne
d	Propane	Propene	Propyne

24- Three organic compounds (A), (B), and (C), each containing two carbon atoms

Compound (A): saturated hydrocarbon, can be liquefied by pressure and cooling

Compound (B): characterized by the presence of one hydrogen bond between Each two molecules

Compound (C): characterized by two hydrogen bonds between each pair of Molecules

- Which of the following represents the correct order of chemical processes required to obtain a saturated hydrocarbon with a boiling point lower than that of compound (A)?

(a) Halogenation of (A) - alkaline hydrolysis – neutralization-dry distillation

(b) Complete oxidation of (B)- addition of sodium hydroxide- dry distillation

(c) Reduction of (C) - dehydration - catalytic hydrogenation

(d) Reaction of (B) and (C) - hydrolysis in an acidic medium - oxidation of the product

25- Monobasic carboxylic acid (containing a number of carboxyl groups equal to the number of carbon atoms) added to alcohol has a freezing point of -110.5°C.

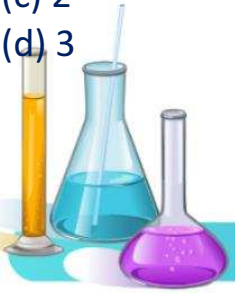
-Which of the following expresses the number of isomers of the resulting compound that have the same functional group group?

(a) 0

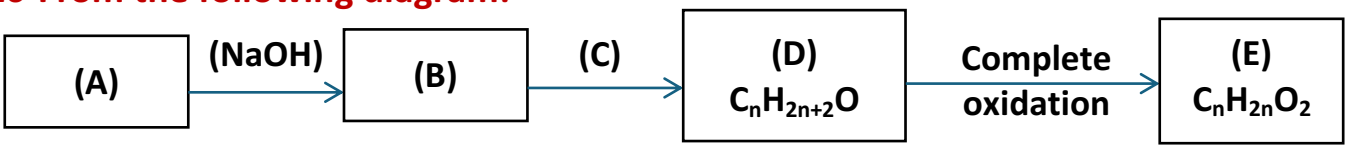
(b) 1

(c) 2

(d) 3



26-From the following diagram:



If you know that organic acid (A) causes muscle contraction when its level in the body increases.

-Which of the following expresses the correct name for each of (D) and (E) and the name of the process (C)?

(A) D: Propanol, E: Propanoic acid , C: Dry distillation

(b) D: ethanol , E: Ethanoic acid , C: dehydration

(c) D: ethanol , E: Ethanoic acid , C: dry distillation

(d) D: propanol, E: propanoic acid, C: dehydration

27- Which of the following expresses the correct order of chemical processes necessary to obtain an organic compound used as antifreeze from cane sugar?

(a)Hydrolysis – alcoholic fermentation – dehydration/140°C – addition of Hydrogen peroxide

(b) Alcoholic fermentation – hydrolysis – dehydration/180°C – Bayer reaction

(c) Hydrolysis – alcoholic fermentation – dehydration/180°C – addition of Hydrogen peroxide

(d) Hydrolysis – alcoholic fermentation – dehydration/80°C – addition of Hydrogen peroxide

28- Three organic acids that do not contain a carboxyl group:

(A): A weak solid acid with a characteristic odor at room temperature

(B): Can be prepared by reacting benzene with a mineral acid by substitution

(C): Used as an antiseptic in treatment of burns

-Which of the following describes the above acids?

(a) Acid (A) can be prepared from acid (B) by complete oxidation in the presence Of a dehydrating agent.

(b) Acid (B) can be prepared from acid (A) by adding concentrated nitric acid in The presence of sulphuric acid.

(c) Acid (C) can be prepared from acid (B) by adding concentrated nitric acid and Sulfuric acid

(d) Acid (B) can be prepared from acid (A) by adding zinc and heating, then Adding concentrated sulphuric acid

29- Which of the following compounds burns in an abundance of oxygen to produce 3 mol of water vapor and 3 mol of carbon dioxide?

(a) Propane (b) Cyclopropane (c) Propanol (d) Propane

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30- Which of the following correctly describes the role of sodium hydroxide in preparation of Paraffins and the role of concentrated sulphuric acid in the preparation of olefins, respectively?

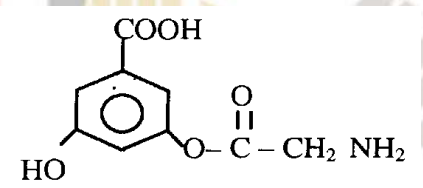
(a) Removing water from alcohols in the preparation of olefins and flux substance In the preparation of Paraffins

(b) Removing the carboxylate group in the preparation of olefins and removing Water in the preparation of Paraffins

(c) Removing the carboxylate group in the preparation of Paraffins and Illuminating water in the preparation of olefins

(d) Absorbing water vapor in the preparation of Paraffins and neutralizing acid Vapors in the preparation of olefins

31-Study the following compound:



Which of the following expresses the correct results when conducting the following experiments on this compound?

Exp. / choices	1- Addition of sodium bicarbonate	2-Reduction with hydrogen then addition of iron III chloride solution	3-Hydrolysis in an acidic medium
A	effervescence occurs and a gas evolves, clouding the clear lime water	The solution turns purple	Benzoic acid is formed
B	No effervescence occurs	The solution turns purple	Acetic acid is formed
C	No effervescence occurs	The color does not change	Glycine is formed.
d	Effervescence occurs and a gas rises, clouding the clear lime water	The solution turns purple	Glycine is formed.

32-Which of the following expresses the correct order of chemical processes necessary to prepare a substance used in printing inks from the compound resulting from the catalytic hydration of the simplest alkyne?

(a) Reduction – esterification – Acidic hydrolysis– thermal cracking

(b) Oxidation – dry distillation – neutralization –passing water vapor

(c) Reduction – dehydration – hydrogenation – Halogenation

(d) Oxidation – neutralization – dry distillation – thermal cracking

33-Which of the following solutions can be added to a solution containing cations (Al^{3+}, Fe^{2+}, Ca^{2+}) to precipitate only one of these cations?

(a) Sodium carbonate

(b) An abundance of sodium hydroxide

(c) An abundance of ammonium hydroxide

(d) Potassium chloride

34- Two consecutive elements (X, Y) from the first transition series, element (X) has the highest oxidation state in the series. Which of the following is correct?

(a) Element (Y) is diamagnetic and its atom contains 6 unpaired electrons

(b) Element (X) is diamagnetic and its atom contains 6 unpaired electrons.

(c) The Y^{2+} ion is paramagnetic and contains 4 unpaired electrons.

(d) The X^{3+} ion is paramagnetic and contains 5 unpaired electrons.

35- When adding 200 mL of 0.2 M sulphuric acid to 300 mL of 0.2M calcium hydroxide according to the following equation:

$$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$$

- Which of the following expresses the concentration of the remaining substance without reaction?

(a) 0.080 M

(b) 0.040 M

(C) 0.066 M

(d) 0.0100 M

36- Which of the following reactions has a (Kc) value equal to the concentration of the products?

(a) $C_{(s)} + O_{2(g)} \rightleftharpoons CO_{2(g)}$

(b) $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$

(C) $H_{2(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(g)}$

(d) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

37- 5L of saturated zinc sulphide (ZnS) solution was cooled from 60°C to 25°C, 1.53×10^{-5} g of the salt is precipitated. If you know that the solubility product Ksp of the salt at 25°C is equal to 1×10^{-21}

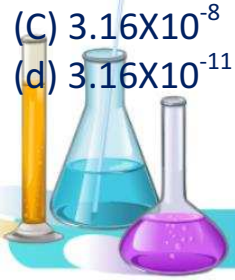
- Which of the following expresses the solubility product constant (Ksp) of ZnS at 60°C? (ZnS = 97 g/mol)

(a) $1 X 10^{-15}$

(b) $1 X 10^{-21}$

(C) $3.16X10^{-8}$

(d) $3.16X10^{-11}$

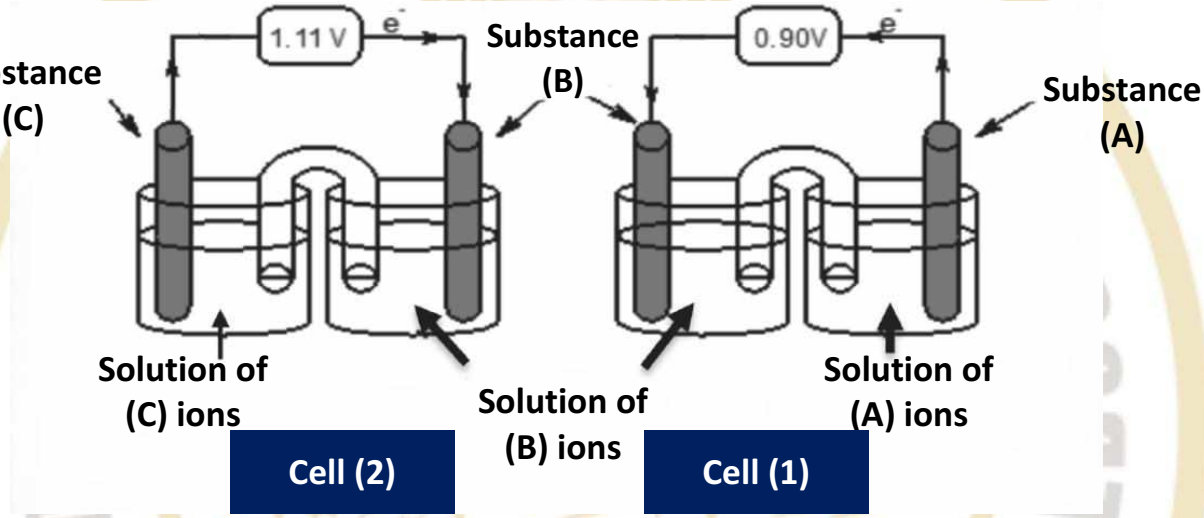


38- When plating a jug with a layer of silver its mass 26.25 g by passing an electric current of 25 amperes through an electrolyte containing silver ions, which of the following is the time required to complete this process?

(Ag = 108 g/mol)

(a) 14.2 minutes
(b) 15.2 minutes
(c) 15.6 minutes
(d) 13.2 minutes

39- The following figure shows two galvanic cells:



-Which of the following is correct for the electrodes (A,B,C)?

(a) (A) is the strongest reducing agent
(b) (C) has the lowest oxidation potential
(c) (B) is the least active electrode
(d) (C) electrode mass increases

40- Three organic compounds (A), (B), and (C) have the molecular formula $C_4H_8O_2$

(A): reacts with sodium hydroxide on cold.
(B): does not react with sodium hydroxide on cold.
(C): undergoes esterification and produces the simplest alcohol.

- Which of the following is correct?

(a) A: butyric acid , B: ethyl ethanoate
(b) C: Methyl propanoate , B: methyl propanoate
(c) A: 2-methyl propanoic acid , C: Ethyl ethanoate
(d) C: Methyl propanoate , B: Butanoic acid

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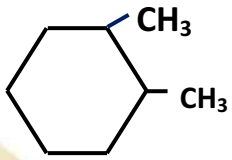
41- The following processes were carried out on organic substance (X) in order (complete oxidation - neutralization - dry distillation - catalytic reforming - complete hydrogenation), and the corresponding compound was one of the products:

- Which of the following compounds could be substance (X)?



(a) 3, 4-dimethyl-1-heptanol
(b) 2, 3-dimethyl-1-hexanol
(c) 3, 4-dimethyl-1-hexanol
(d) 3, 5-dimethyl-1-heptanol

42- Which of the following expresses the correct order of chemical processes necessary to obtain an organic substance used as a food preservative and prevents the growth of fungi?

(a) Trimerization of acetylene - Halogenation in presence of a catalyst - Alkaline hydrolysis - reduction
(b) Catalytic reformation of hexane - alkylation - oxidation - neutralization
(c) Reduction of phenol - alkylation - oxidation - reduction
(d) Fractional distillation of coal tar - Halogenation in presence of a catalyst – Alkaline hydrolysis - alkylation

43- The general formula $C_4H_{10}O$ represents three alcoholic isomers (A), (B), and (C)

(A) : Contains two methyl groups.
(B) : Contains three methyl groups
(C) : Contains one methyl group.

- Which of the following expresses the correct IUPAC name for the product of adding acidified potassium permanganate to each of (A), (B), and (C)?

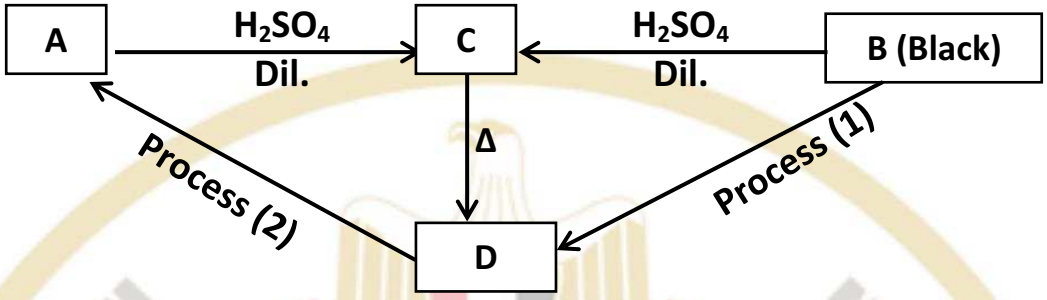
Choices	In case of (A)	In case of (B)	In case of (C)
A	2-butanone	2-methyl-2- propanoic	No reaction
B	2-methyl -2-propanoic	No reaction	2-butanone
C	No reaction	2-methyl -2-propanoic	2-butanone
d	2-methyl propanoic	No reaction	Butanoic acid

44-Which of the following alcohols oxidize with acidified potassium dichromate, and when dehydrated with concentrated sulfuric acid at 180°C, do not give 2-methyl-1-butene?

(a) 2,2- Dimethyl-2-butanol
(b) 2,2-Dimethyl-1-propanol
(c) 2-Methyl-2-propanol
(d) 2-Methyl-1-butanol

Essay questions:

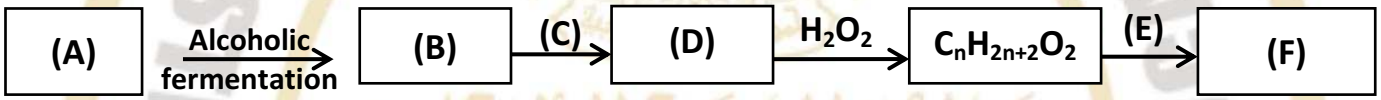
45-The following diagram represents some of iron and its compounds reactions:



(a) Mention the names name each of the processes (1) and (2)

(b) Write the chemical formula for each of (C) and (D)

46- Study the following diagram:



- If you know that (F) is a dibasic carboxylic acid

(a) Write the names of organic compounds (A) and (D)

(b) Name the compounds (C) and (E)

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